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TO THE

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT
UNITED STATES HOUSE OF REPRESENTATIVES
CONCERNING THE ROLE OF OFFSETS IN CLIMATE LEGISLATION

Introduction

Mr. Chairman and members of the subcommittee, I am honored to appear before you to testify on the performance and potential role of international carbon offsets in US climate policy. Overall, I believe that these markets hold limited promise, both as a cost control mechanism and as a method of engaging developing countries on the problem of climate change while also presenting substantial risks. The market I study most closely, the Clean Development Mechanism (CDM) of the Kyoto Protocol, has grown into the worlds largest carbon offset market, with hundreds of millions of credits worth tens of billions of dollars changing hands annually. Carbon offsets are in essence, a payment in exchange for a commitment to alter behavior in ways that lead to reduced emissions of greenhouse gasses (GHGs). Buyers of these credits, both governments and private firms, can then utilize them for compliance purposes in lieu of reducing their own emissions.

In this testimony I will address the lessons learned from the CDM experience so far, what the US could do to improve the situation if it adopts an emissions trading system that includes international offsets, what incentives such a system will create for developing country climate policy and how the US should manage these, the role that sectoral programs, as opposed to the project based approach best illustrated by the CDM should take, and what lessons the CDM holds for design of a carbon credit system aimed at reducing emissions from deforestation and degradation (REDD). I conclude the following:

(1) There has been and will continue to be substantial crediting of business-as-usual behavior within the CDM. This is particularly true for sectors such as electricity generation that are highly regulated by developing country governments.

(2) The US should use its market power in an international carbon offsets system to improve its environmental integrity by forcing administrative reforms and limiting its purchases to offset

categories where real reductions can be readily separated from business as usual

(3) US climate legislation should include both carrots and sticks to induce developing countries to give up offsets in favor of binding limits on emissions.

(4) The US should encourage the creation of sectoral baseline and credit schemes in developing countries by providing access to the US emissions trading market.

(5) The US should, it it allows REDD credits into a domestic emissions trading market, mandate both national deforestation baselines and minimum participation by tropical forest nations. Both are needed in order to reduce within-country and international emissions leakage caused by a large scale REDD program.

All offset markets, whether for GHGs or for criteria pollutants, face a tension between creating the right conditions for investment and insuring environmental integrity. On the one hand they must create sufficient investor confidence to induce participation. On the other hand, they must try to insure that payment is only made for actual alterations in behavior rather than what for would have happened anyway. These goals necessarily conflict because increased environmental oversight implies both greater oversight costs and also a higher risk that claimed reductions by a project will not be given credit.

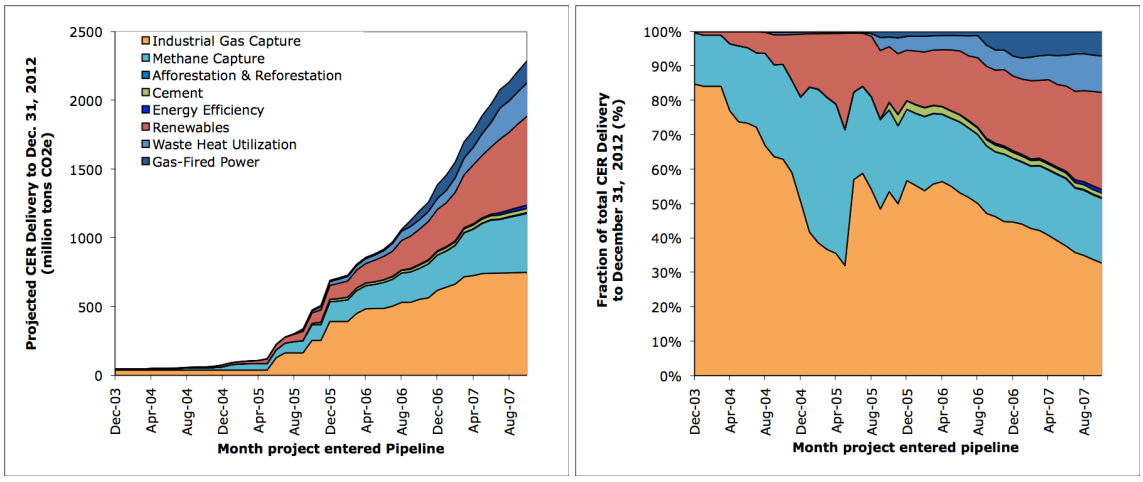
A carbon offset market, if perfect in both design and implementation, is a zero-sum game. Emissions are reduced at carbon offset projects. These emissions reductions then allow firms with compliance obligations to emit more than they otherwise would and at a lower per ton cost. If however, design or oversight is imperfect, with some offset projects securing credit for reductions that do not represent real alterations to their baseline emissions, getting paid to do what they would have done in any case, then emissions will be unchanged outside of the cap but higher within the cap.

<u>Lessons learned from the Clean Development Mechanism with regard to environmental integrity in a mandatory cap-and-trade program to reduce greenhouse gas emissions</u>

The CDM has struck the balance between investor risk and environmental integrity in different ways at different times as the market has developed since the CDM Executive Board (CDM EB), the market regulator, first began evaluating offset projects in 2004. Overall, I would argue that the market today presents both an unacceptable risk to investors and a portfolio of projects of dubious environmental credibility. Major offset project developers are in crisis because they cannot bring sufficient credits to market to meet their delivery commitments to compliance

buyers in the European Union Emissions Trading Scheme. At the same time, many critics of the program have amassed evidence that in too many cases, projects that almost certainly would have proceeded without assistance from the CDM are nevertheless being issued carbon offsets. One preliminary lesson to draw from this early outcome is that well designed offset markets should be limited to offset project types where assessing environmental credibility is simple and so cheap and low-risk. This will both increase the quality of the environmental outcome produced, help to insure investor confidence and hence

The growth of the CDM has been truly extraordinary. In 2007, the value of the CDM market totaled €12 billion, more than triple the previous year's figure. The CDM project pipeline has grown in four years from essentially nothing to more than 3000 projects either registered or in the process of achieving the necessary regulatory approvals. The project design documents for these projects together project that the CDM market will deliver more than 2.2 billion credits to the end of the Kyoto Protocol's compliance period (see Figure 1).



a. b.

Figure 1: Participation in the Clean Development has grown explosively over the past four years. Shown in (a) is the projected volume of Certified Emissions Reductions (CERs) delivered to the end of the Kyoto Protocol as a function of time. Different colors indicated different project types. Shown in (b), the same data, but expressed in percentage terms. Early on, industrial gas capture projects, most notable HFC-23 capture projects, dominated the supply of credits. More recently, renewable power and natural gas-fired power projects have been growing in importance.[1]

[1] Data courtesy of Jørgen Fenhann, UNEP-Risø Centre, CDM-JI Pipeline Database, *at* http://www.cdmpipeline.org.

The early history of the CDM is primarily the story of an obscure gas called trifluoromethane or HFC-23. This gas is a potent GHG and is produced mainly as a waste product during the manufacture of another gas (HCFC-22). The HCFC-22 is used in some air conditioners and as a feedstock for high performance plastics; it is a partial replacement for other gases that are being phased out because they harm the ozone layer. HFC-23 is 11,700 times more potent a greenhouse gas than CO_2. Projects that cut HFC-23 emissions are extremely valuable because they generate enormous volumes of carbon offsets, or in the CDM's terminology, Certified Emissions Reductions (CERs) at very low cost. In the early development of the carbon market, these projects made up the bulk of emissions reductions. (See Figure 1). They also accounted for the vast majority of financial value in the nascent, rapidly growing CDM market in 2004-2006 that sparked early excitement about carbon offsets as an investment opportunity.

The costs of capturing and destroying HFC-23 at refrigerant plants are non-zero but extremely low. In the U.S. and Europe, many factories producing this waste gas have since the 1990's voluntarily eliminated their emissions of HFC-23.[2] In the developing world by contrast, until the CDM, refrigerant factories simply vented this potent GHG. Because of the low costs of destroying the gas and its high potency, initially it was thought these projects would be ideal offset projects for the CDM scheme. At the same time, our work along with the highly successful fund within the Montreal Protocol on the ozone layer (which funded an analogous phaseout of industrial chemicals) suggested that these types of emissions should be handled outside of the Kyoto market system via a dedicated fund.[3]

Unfortunately, close scrutiny of the economics of HFC-23 projects revealed that they were, in many senses, too good to be true. Our work[4] and the work of others[5] showed that the sale of carbon credits generated from HFC-23 capture is far more valuable than production of the refrigerant gas that leads to its creation in the first place. Thus, refrigerant manufacturers were transformed overnight by the CDM into ventures that generated large volumes of CERs, with a sideline in the manufacture of industrial gases. In response to these perverse incentives, the CDM Executive Board implemented a number of restrictions that limited, but failed to

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[2] Indeed, technologies developed and deployed voluntarily in U.S. plants are the same as those that have been adopted in the CDM. A. McCulloch, *Incineration of HFC-23 Waste Streams for Abatement of Emissions from HCFC-22 Production: A Review of Scientific, Technical and Economic Aspects*, 18 (2005) *at* http://cdm.unfccc.int/methodologies/Background_240305.pdf (last visited April 14, 2008).

[3] David G. Victor and Gordon J. MacDonald, *How to Make Kyoto a Success*, 389 NATURE 777 (1997); David G. Victor and Gordon J. MacDonald, *A Model for Estimating Future Emissions of Sulfur Hexalfuoride and Perfluorocarbons*, 42 CLIMATIC CHANGE 633 (1999).

[4] Michael Wara, The Performance and Potential of the Clean Development Mechanism, PESD Working Paper #56 (2006), *available at, http://pesd.stanford.edu/cdm.*

[5] UNEP Technical and Economic Assessment Panel, Response to Decisiion XVIII/12, Report on the Task Force on HCFC Issues (with particular focus on the impact of the Clean Development Mechanism) and Emissions Reduction Benefits Arising from Earlier HCFC Phase-Out and Other Practical Measures (August 2007).

eliminate, the perverse incentive to produce refrigerant in order to produce waste HFC-23, capture this waste, and so create enormous quantities of CERs.

In the case of HFC-23 abatement, the CDM was also a startlingly inefficient means for achieving emissions reductions in the developing world. Payments to refrigerant manufacturers, the Chinese government (which heavily taxes these CDM projects), and to carbon market investors by governments and compliance buyers will in the end total approximately €4.7 billion while estimated costs of abatement are likely less than €100 million. Given limited funds to invest in developing world climate abatement, there is a need for mechanisms to access extremely low-cost emissions reductions via more cost-effective mechanisms. Elsewhere I have outlined such systems, which could include a project fund such as was done in the highly successful multilateral fund under the Montreal Protocol on Substances to Deplete the Ozone Layer.[6]

Over the last two years, awareness of the HFC-23 problem has grown and governments have tried to clamp down on these projects. By stemming the flow of HFC-23 credits while encouraging growth in other types of offset projects, it was thought, the CDM would at last encourage investment in activities that would deliver more fundamental changes in technology, leading to reductions in emissions. For example, it was thought that countries would invest in new energy systems that had much lower carbon emissions. Indeed, the CDM market has shifted, as shown in Figure 1—today, HFC-23 projects account for less than half of projected project deliveries, and that fraction is declining. The good news, in theory, is that most of the growth in CDM has been outside the HFC-23 sector (and projects involving other industrial gases with similar drawbacks). The bad news is that these new projects reveal even deeper problems with the CDM mechanism—problems that, for projects that could theoretically deliver the largest reductions in emissions, can't be fixed.

I focus my discussion on China because it is the most important developing nation in terms of GHG emissions and because current market trends indicate that more than half of all emission credits will likely originate in reduction projects based there.[7] I focus on the energy sector because it is fundamental to making a dent in GHG emissions and because it is where the fastest growth in the Chinese CDM pipeline is occurring. Energy projects are crucially important, and under the current rules such projects offer the greatest potential for future growth in the CDM.

In China, coal-fired power plants generate approximately 80% of all electric power. Most of the existing plants are older, inefficient designs, but most new plants being built are state of the art. And China is building new power plants at a truly

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[6] Michael Wara, *Is the Global Carbon Market Working*, 445 NATURE 595 (2007); RICHARD ELLIOT BENEDICK, Ozone Diplomacy: New Directions in Safeguarding the Planet, (2nd ed., Harvard University Press 1998).

[7] As of January 1, 2008, 53% of CERs issued to 2012 will be created in China, assuming that all projects currently undergoing validation are registered. Jørgen Fenhann, UNEP-Risø Centre, CDM-JI Pipeline Database, *at* http://www.cdmpipeline.org.

astonishing rate. During each of the past two years, approximately 100 GW of new electric generating capacity was constructed in China; rapid buildout of coal plants is expected for the foreseeable future in the country.[8] The astonishing rate of growth is equivalent to building the entire U.S. power plant fleet in less than a decade.[9] This new demand has put enormous strain on China's coal supply system, including its mines and railroads, as evident in the spate of blackouts in January. After many years as a coal exporter, China is now a net importer of coal. In addition to unreliable power, combustion of coal with dirty technologies contributes to the country's soaring rates of childhood asthma and the other ills of air pollution.

In response to these problems, the Chinese government has implemented a series of policies to both reduce the country's dependence on coal and to reduce the environmental impacts of electricity generation. China's current five-year plan, in fact, calls for major investments in hydro, wind, nuclear[10], and natural gas-fired power in order to diversify away from excessive reliance on coal. A 4,000 km long pipeline from the country's western gas fields to the booming cities in the east has been completed. A second, even larger pipeline is now under construction. In 2006, a Renewable Energy Law entered into force that provides strong financial incentives for development of new wind farms in China and sets explicit capacity expansion goals for the wind sector. Since 2004, China has been on a dam building spree, with 10 GW of new hydro power plant capacity being completed each year.

These changes in China's goals are evident not only in energy policy but also in China's CDM projects. Today, as illustrated in figure 2, essentially all new hydro, wind, and natural gas fired capacity is applying to claim credit for emissions reductions under the CDM. These power plants are at least potentially eligible for the difference between their emissions and the electricity they "displace" on the Chinese electricity grid. Under the rules of the CDM, each new dam, wind farm, or natural gas power plant applies individually and makes the argument that it would not have been constructed but for the financial incentives produced by the sale of carbon offsets.

Taken individually, these claims may make sense—because, individually, any particular power plant utilizing non-coal sources of energy probably faces greater hurdles than new coal-fired generation or may be financially marginal, and the ability to sell CERs offers the prospect of being able to compete toe-to-toe with coal.[11] Taken collectively however, these individual applications for credit amount

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[8] On the rate of power plant construction in recent years see: Keith Bradsher, *China's Green Energy Gap*, NEW YORK TIMES, October 24, 2007. For projections see International Energy Agency, 2007, *World Energy Outlook 2007* (Paris: IEA).

[9] The U.S. power plant fleet had a total nameplate generating capacity of 955 GW in 2006. *See* Energy Information Administration, Annual Energy Outlook 2008 (Revised Early Release).

[10] Nuclear power, although a source of low-carbon energy, is ineligible to participate in the CDM under the current rules.

[11] Additionality within the CDM is evaluated in a variety of ways. Projects show they are additional by comparing the proposed activity to what is required by regulation, to what is the most financially

to a claim that the hydro, wind, and natural gas elements of the power sector in China would not be growing *at all* without help from CDM. This broader implication is simply implausible in light of the state policies described above. That so many plants would come forward to claim credit as marginal indicates systemic problems with the CDM project evaluation and approval process. These problems are probably just the beginning, as efforts are under way to apply a methodology that would allow investors to gain credit for installing more efficient "supercritical" coal-fired power plants in China—despite the fact that many such plants are already being built without CDM credits and such plants are probably cost-effective in many Chinese power markets on their own.[12]

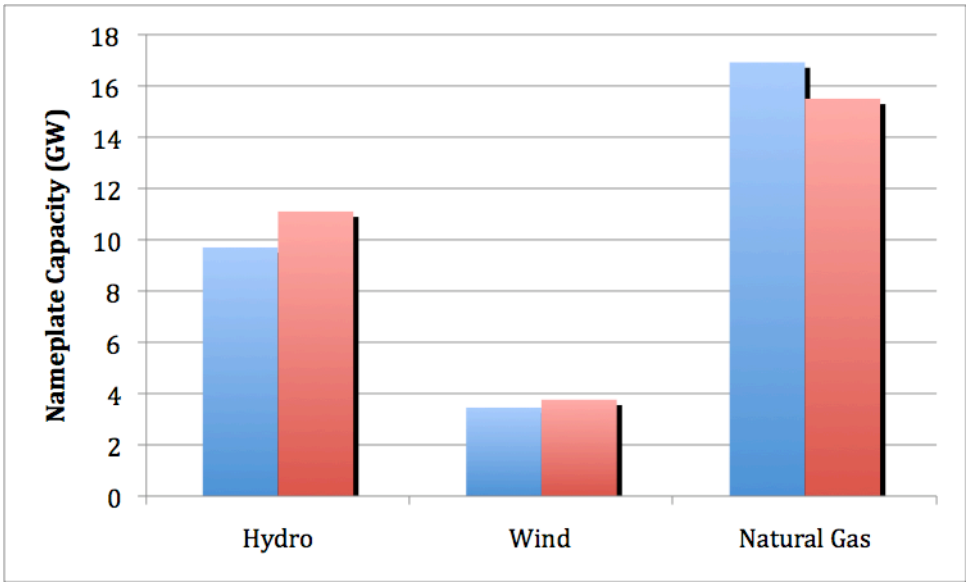

Figure 2: Hydro, wind, and natural gas fired power plants built or under construction in China compared to applications for CDM crediting for these projects. Essentially all new capacity (blue bars) is applying for CDM offset credit (red bars). Issued credits are based on the difference between these new energy sources and the Chinese grid GHG emission intensity. Shown are new capacity and CDM applications for Chinese hydro and wind power in 2007, and for natural gas-fired power in 2005-2008.[13]

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attractive activity under the applicable circumstances, and by assessing any other barriers to implementation of the project.

[12] In September, 2007, the CDM EB approved a methodology for crediting supercritical and ultra-supercritical coal fired power plants. *See* http://cdm.unfccc.int/methodologies/DB/C7O6IUA9OTNRUK4X619VX2A6OS4DU7/view.html. China has also been pushing construction of these plants as a response to the severe shortages of coal in southern China. *See* Information Office of the State Council of the People's Republic of China, China's Energy Conditions and Policies, (December 2007); *See also*, Keith Bradsher, *China's Green Energy Gap*, NEW YORK TIMES, October 24, 2007.

[13] Hydro and wind CDM applications exceed new capacity additions in part because some plants applying

These problems are not peculiar to the Chinese context. They reflect a fundamental challenge in any offset system. The host governments and investors that seek credit have a strong incentive to claim that their efforts are truly additional. The regulator—in this case, the CDM Executive Board—can't in many cases gather enough information to evaluate these claims. These problems of asymmetrical information are compounded in the CDM, to be sure, because the CDM Executive Board is massively under-staffed and the CDM system relies on third-party verifiers to check the claims made by project proponents. In practice, these verifiers, who are paid by the project developers, have strong incentives to approve the projects they check. Further, there is scant oversight on the integrity of the verification process and little record of punishing verifiers for misconduct. Lacking any other source of information about individual projects and facing pressure from both developing and developed country governments, the CDM Executive Board is prone to approve projects. Asymmetries of information are rampant; the incentives mostly align in favor of approval.

This challenge is made all the more formidable by the sheer number of projects upon which the Board must decide. The CDM EB, on average, registers about one project every day as eligible to generate CDM credits. Thus the Board cannot afford to spend large amounts of time evaluating the complexities of financial data presented to justify a project's eligibility for CDM credits nor can it delve into a project's relationship to state energy policy. Furthermore, the CDM EB faces a financial limit on the costs it can reasonably impose on individual offset projects. In order to remain viable, relatively small carbon offset projects cannot afford the cost and uncertainty that would accompany truly extensive scrutiny. Indeed, there is strong pressure from CDM investors to limit such transaction costs and speed up approval.

<u>The US can take steps to enhance the effectiveness of an international offsets program such as the CDM</u>

This description of the current state of the CDM leads directly to a number of policy recommendations. The US, because it will likely be the largest buyer in any international carbon offset market, will likely have significant influence over the rules governing the market. It should use this influence both to push for three major reforms to the CDM. First, the US should urge reform of the regulatory framework that currently governs the CDM to increase transparency, fairness, and accountability. Second, it should push for changes in the ways that third-party verifiers are compensated within the system in order to remove pervasive conflicts

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for credit in 2007 were built earlier and in part because some plants that applying for credit experienced construction delays. Data Sources: National Development and Reform Council; International Gas Union; International Energy Agency; Jørgen Fenhann, UNEP-Risø Centre, CDM-JI Pipeline Database.

of interest that likely lower environmental standards in impossible to monitor ways. Third, the US should limit its purchases of international offset credits to those offset project types where evaluation of additionality is relatively less complex and so more likely to be accurate.

The current governance structure of the CDM needs overhaul. In essence, the market is run by a part-time board of political appointees who, while operating in a quasi-judicial role, is not required to give reasons for its decision and is not bound to follow precedent or even explain why current decisions deviate from past practice. All this needs to change. The CDM EB needs full time attention from experts in the area of carbon offsets. The US should demand as much. It should also work to compel the board to give reasoned explanations for its decisions to approve or disapprove projects. Without such a case law, it is both difficult to assess the standards that the board is applying and to judge whether a project will likely survive scrutiny or not. This leads to perceptions of arbitrariness on the part of both project developers and environmental NGOs alike. Finally, the board should, at a minimum, have to explain why its current decisions deviate from past practice when it decides to change course. While not necessarily being compelled to follow its own precedents, a requirement to explain course changes will provide important insights into the reasoning behind CDM EB decision making, thus increasing both predictability and transparency. All this will allow both market participants and critics of the system to better assess its performance.

Third-party verifiers play an essential role in the implementation of international carbon offset systems. They check that the claims made regarding the additionality of projects are correct. They also monitor compliance with promised emission reductions by offset projects. Yet they face a series of incentives that likely leads them to cut corners in ways that compromise their effectiveness in these roles. First and foremost, verifiers in the CDM are currently hired and paid by the project developers, most of whom are repeat players in the market. Thus verifiers have incentives to please their client rather than to exercise rigorous oversight. In addition, verifiers must bid competitively for verification contracts, which creates incentives to cut corners and lower the stringency of audits. The US should act to remedy this situation by requiring that the regulator rather than the project developers contract for and pay third-party verifiers in any offsets system from which it purchases credits.

Finally, as has been illustrated in the previous sections description of the Chinese energy projects participating in the CDM, there are some sectors where a combination of factors make the determination of baselines a very difficult endeavor. These factors include a coincidence of climate and energy security concerns, heavily regulated industries that lack market signals, pervasive participation in these sectors by state owned entities, and project business models where the cashflow attributable to the CDM is a very small proportion of total income earned by the project. The US should, rather than attempting to design a system that can identify the wheat from the chaff in these sectors, simply opt not to purchase offsets from them. Limiting access to US markets to the offset project

types where evaluation of additionality is more straightforward will go a long way towards improving the environmental credibility of any international carbon offsets program.

The US should create incentives for developing countries that participate in a US international offsets system to eventually take on binding emissions limits

The ability to produce and sell carbon offsets is a potential asset on a firm's balance sheet. In contrast, the requirement to comply with a cap-and-trade regime is an environmental liability. This difference illustrates why creating an expectation on the part of developing countries or developing country firms that they will be entitled to produce and sell large numbers of carbon offsets to the US may prove problematic in the medium- to long-term. Carbon offsets are intended to be a bridge - both for developing countries and for developed country firms - to a future where the former accepts caps and the latter adopts new technologies as they become available. In order to insure this future, it is important that medium- and long-term expectations be set at the outset.

The CDM does help developing country firms and governments take important steps down the road towards an eventual cap on emissions. It familiarizes participating firms with the accounting tools that will be necessary and with the sort of planning and business decision making that will be essential to ultimate compliance with a cap-and-trade regime. At the same time, it creates expectations on the part of some offset projects of up to a 21-year lifespan. Thus a project begun today might expect to be generating credits for sale in 2040. But by 2040, major developing countries, especially China and India, where most CDM projects currently exist, must have accepted caps on their emissions or the global project to limit damages from GHGs will likely have been undermined. Congress should set clear and explicit limits on the term during which the US will accept international carbon offsets from nations that have not entered into binding limits on their emissions via international agreement.

Limitations on future purchase of offsets designed to minimize developing country incentives to avoid caps might take three forms. First, Congress could set explicit dates in climate legislation at which time the volume of offsets that firms could utilize for compliance with a US cap would decrease. Second, Congress could set a date certain in climate legislation after which offsets from countries which have not taken on an economy-wide cap on their emissions would not qualify for use within the US emissions trading system. Finally, it may also be possible to modify the rules of the CDM so that current and future international carbon offset projects will be difficult or impossible to renew beyond their initial seven year terms.

Finally, it should be emphasized that the US holds a potentially valuable carrot to induce developing countries to accept a cap and give up offsets, at least within capped sectors. This is access to the US emissions trading scheme without ny

quantitative limits. Many legislative proposals have limited the number of international offsets that may be utilized within the US cap-and-trade. EPA and EIA modeling suggest that these limits may be binding on regulated entities within the caps, at least initially. Thus providing for full market access to the US emissions trading regime for developing country cap-and-trade programs that make acceptable efforts to reduce emissions could provide a substantial increase in revenue flows while also providing continued cost-control for US firms.

The US should Encourage the development of sectoral, as opposed to project-based offset systems in major developing countries as a bridge to accepting caps

Many of the sectors that have proven so problematic to include within the CDM because of difficulty with additionality might be better included, even within an international offsets mechanism, at the sectoral level. There have been numerous recent proposals along these lines for key sectors within China and India. The basic idea is that a sector of a nation's economy would accept a target for its GHG emissions in a future year. If it met or exceeded that target, then the sector would generate credits that could be sold to developed country emitters, in much the same way that CDM credits are today. If it failed to meet the target however, it would not face any sanctions.

The advantage of such a proposal is that it moves from project-by-project assessment of additionality to wholesale assessment of changes in emissions within a larger segment of an economy. This allows for perhaps more honest assessment of trends in adoption of new technologies and their impact on baseline emissions. Also, for sectors like electricity generation, that are highly regulated, a sectoral approach brings the regulator, and the influence it can exert upon firms, into the discussion of target setting. As can be seen from the Chinese power sector projects, this is an essential component of baseline and credit systems in the power sector, whether they are project-based or sectoral in approach.

Implementing a sectoral approach will not be without substantial challenges. Questions that remain to be addressed include just how to set sectoral targets, how these targets will be monitored and enforced in practice, and how the risks and benefits of a sectoral approach will be distributed across the sector, presumably by the government agency responsible for the program. All of these are, difficult problems to resolve for any nation's climate policy. Note however that these are very similar to the issues and challenges that must be overcome if a nation is ever to agree to a cap on its emissions. Thus sectoral approaches represent a transition phase between a project-based offsets regime and more rigorous binding limits on emissions. We should encourage and assist developing countries that are interested in attempting to implement such programs in doing so by providing priority market access to the US emissions trading system for any credits that they generate.

Include Reduced Emissions from Deforestation and Degradation (REDD) only if national baselines can be negotiated and if participation on the part of major tropical forest nations is substantially complete.

Emissions from tropical deforestation represent somewhere between 17 and 25% of global GHG emissions. The uses to which deforested lands are typically put in tropical developing countries have relatively low values when compared to the carbon value of leaving the forests intact. This combined with the fact that many groups have long promoted preservation of tropical forests in order to preserve biodiversity has led to the promotion of REDD as an alternative international carbon credit mechanism.

One key question in the design and implementation of a REDD program, either under US law or via international agreement, upon which CDM experience may shed light is whether to set baseline emissions at the project or the national level. On balance, the CDM experience argues strongly for a national, rather than a project-by-project approach. Two arguments support this view. First, experience in the CDM has shown that in sectors where government is an important player, a project-by-project approach is problematic. Second, emissions leakage concerns arise for avoided deforestation projects that are difficult if not impossible to address at the project level.

The forestry sector, much like the electricity sector, is one that in most countries is highly regulated. It is also one in which there are significant legal and regulatory issues, both as concerns property and land tenure rights and illegal cutting of timber that lead to higher emissions. Carbon markes require clear chain of title and enforcement of the right to exclude individuals from protected forests. One recent study suggested that four times as much timber is exported from Vietnam as is legally harvested there. Both sets of concerns are only addressable via improvement of developing country institutions. These types of concerns suggest a role for a sectoral, as opposed to a project-by-project approach. By setting national baselines and administering a carbon credit system at the national as opposed to the project level, key agencies within developing countries can be given both incentives and resources to improve land use practices in ways that benefit climate.

If REDD becomes a major component of US or EU climate policy, the money provided to preserve forests in major forest nations will have a major impact on land use patterns. These patterns are currently driven by agricultural commodity and timber prices. With the advent of large-scale REDD policies, these other influences will not cease. Far more likely is that they would be displaced to areas not subject to the influence of REDD. Thus trees preserved in one location will create stronger incentives to cut down forest elsewhere. And the more successful the REDD program, the stronger these incentives to create deforestation GHG emissions in other locations will be. This problem, called leakage, suggests two key features of a successful REDD policy: national baselines and minimum participation requirements. By setting objectives for REDD at the national rather than the project

level, leakage within individual developing countries can be managed. By setting minimum participation requirements – for instance that a majority of tropical forest land and a majority of tropical forest nations must opt in to the program in order for it to take effect, the US might substantially limit these leakage problems.

Conclusion

Carbon offsets, and international carbon offsets in particular, pose substantial risks to the environmental integrity not to mention the public reputation of a US emissions trading system. Learning and applying the lessons of the CDM can play an important role in minimizing these risks. Still, any large offset program is likely, at least to some extent, to allow crediting of non-additional projects while creating incentives to defer acceptance of a cap on emissions. While these problems cannot be eliminated, they can to some extent be reduced by smart design choices. The US, because it will likely be the largest purchaser of carbon offsets in the international emissions trading market, should use its clout to make sure that the right decisions are made.